Airbag having tubular conduit folded back on itself for delivery of inflation gas.

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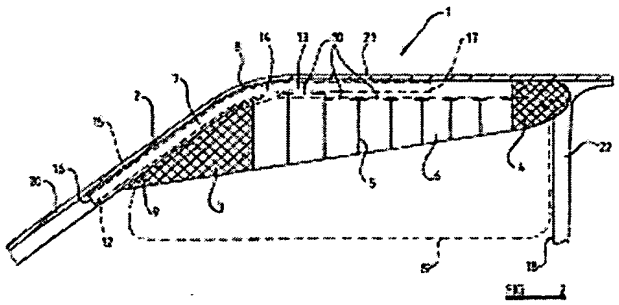
Abstract of **GB2314300**

An airbag 1 is defined by a peripheral seam 2 and interconnected panels 3, 4 and comprises a plurality of vertical, cylindrical cells 6 separated by seams 5, the cells communicating with a flow passage 7 via apertures in their upper ends 10. The flow passage is tubular and initially extends away from the airbag, the passage then being folded back inside itself 12 to form an inner tubular wall to the passage with the fold 16 being attached to the gas generator. Breaks 13, 14 in the inner wall ensure that the gas is fed preferentially to selected cells of the airbag and, in one embodiment, the open end 17 may be of reduced diameter (25). Fig. 4 shows cell seams (26, 27) at the apertures (28) connecting them to the flow passage curved away from the direction of gas flow for streamlining.



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(54) Airbag having tubular conduit folded back on itself for delivery of inflation gas.

(57) An airbag 1 is defined by a peripheral seam 2 and interconnected panels 3, 4 and comprises a plurality of vertical, cylindrical cells 6 separated by seams 5, the cells communicating with a flow passage 7 via apertures in their upper ends 10. The flow passage is tubular and initially extends away from the airbag, the passage then being folded back inside itself 12 to form an inner tubular wall to the passage with the fold 16 being attached to the gas generator. Breaks 13, 14 in the inner wall ensure that the gas is fed preferentially to selected cells of the airbag and, in one embodiment, the open end 17 may be of reduced diameter (25). Fig. 4 shows cell seams (26, 27) at the apertures (28) connecting them to the flow passage curved away from the direction of gas flow for streamlining.

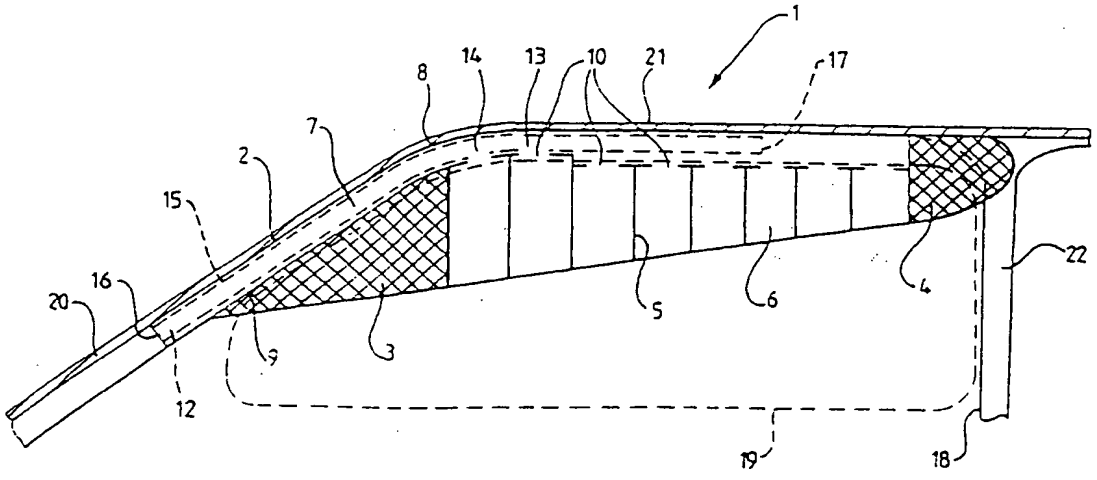

FIG 2

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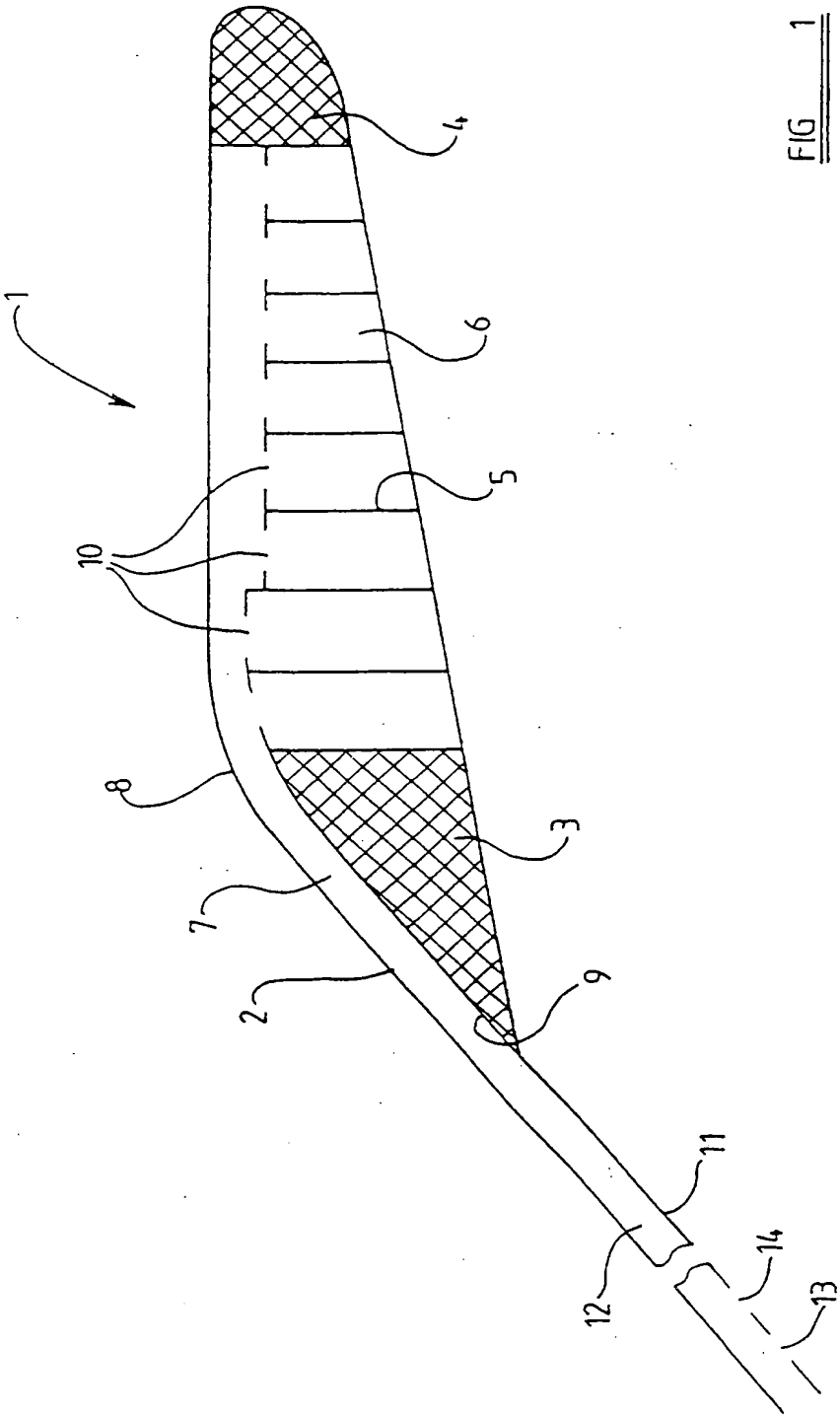

FIG 1

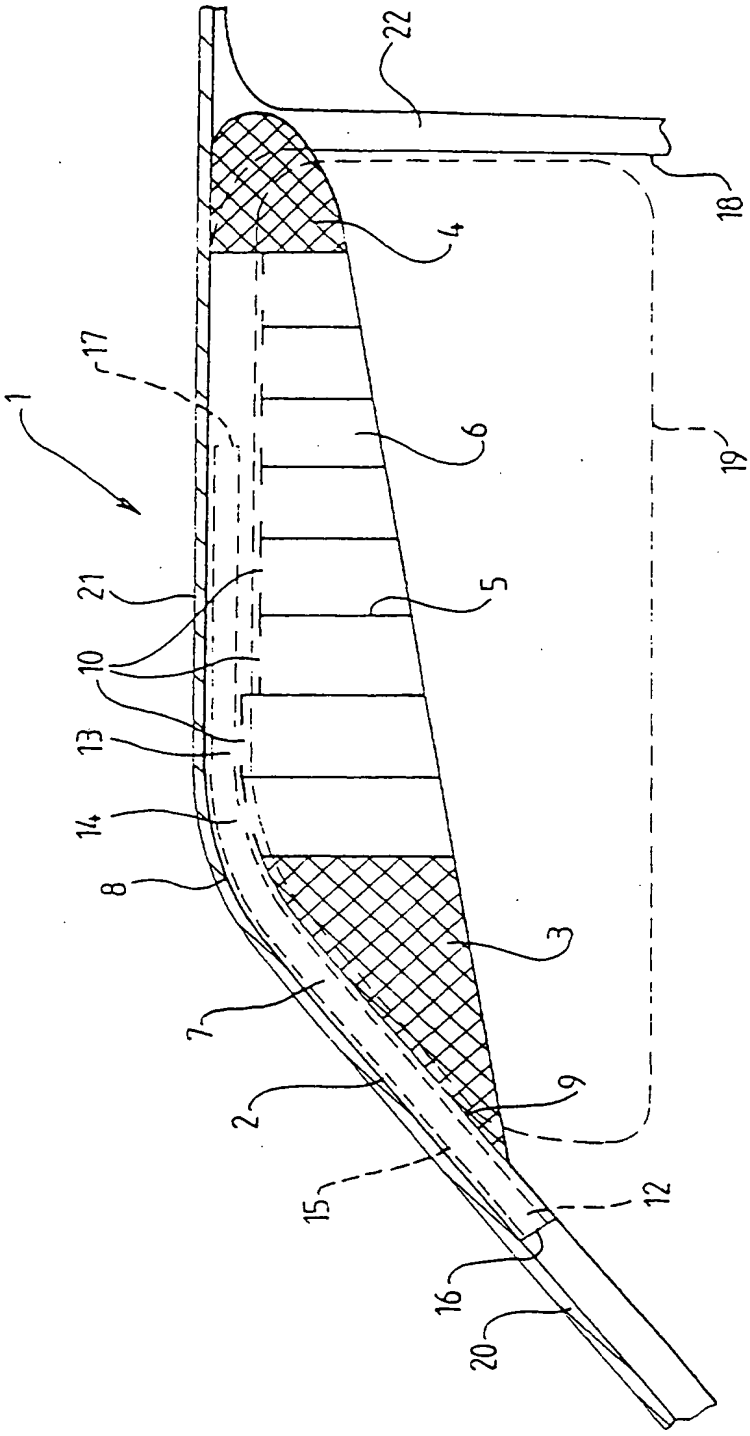

FIG 2

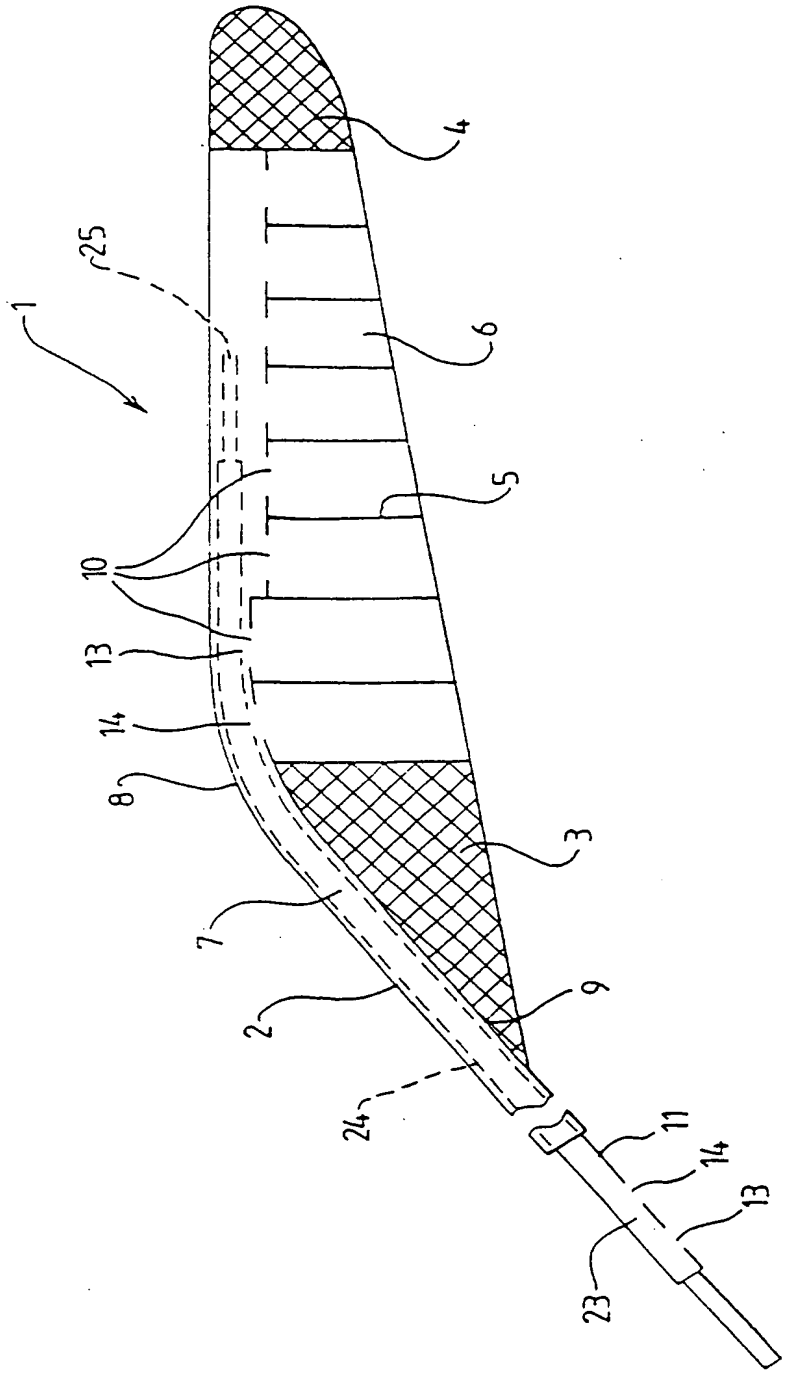

FIG 3

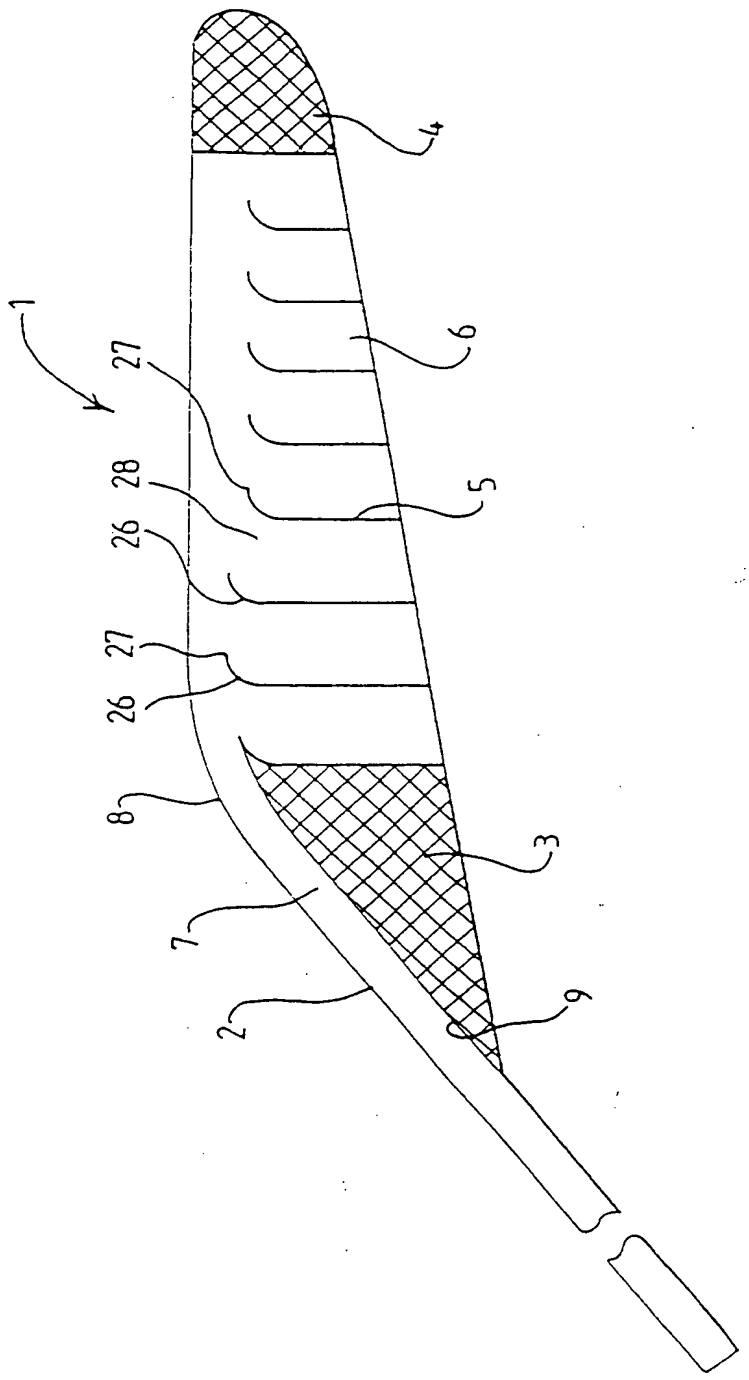

FIG 4

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO AN AIR-BAG ARRANGEMENT"

THE PRESENT INVENTION relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement for use in a motor vehicle such as a motor car.

It is known to provide air-bags in motor vehicles, such as motor cars, which air-bags are adapted to inflate in the event that an accident should arise, to provide protection for an occupant of the vehicle.

It has been proposed to provide a side-impact air-bag which, when inflated, is located between the head of an occupant of the vehicle and a window present in a door of the vehicle. The purpose of such an air-bag is to prevent the head of the occupant hitting the window and also to prevent the head of the occupant from emerging through the window opening if the window should be broken, or if the window is in its lowered position.

If a side-impact air-bag is to perform its desired function effectively, it must be inflated extremely quickly, typically within 10 to 30 milliseconds, in the event of a side impact. It is well known to provide air-bags with a gas generator which communicates with the air-bag and which supplies a large volume of gas at high velocity to inflate the air-bag. Such gas generators may include pyrotechnic devices which fire in response to an indication that an accident is occurring or is likely to occur. The pyrotechnic device

produces a large volume of gas at a considerable temperature. Alternatively, the gas generator may be of a "cold gas" type, using helium for instance. Such "cold gas" generators produce gas at extremely high velocity, resulting in a considerable shock wave.

Due to the extremely short time period in which the air-bag must be inflated, it is often desirable to direct the flow of gas towards those parts of the air-bag which provide the most protection to the occupant, thereby ensuring that those parts of the air-bag are inflated first. It is also desirable to provide a flow channel with sufficient strength to withstand the very high temperature and pressure of the gas, in the case of pyrotechnical gas generators or to withstand the shock wave generated by the gas of a "cold gas" generator.

The present invention therefore seeks to provide an improved air-bag arrangement.

According to this invention there is provided an air-bag arrangement for a motor vehicle, which air-bag arrangement comprises an air-bag adapted to be inflated in the event that an accident should occur, said air-bag being provided with a flow passage disposed therein, said flow passage being connectable to a gas generator, there being provided within said flow passage an inner tubular element.

Preferably said tubular element is formed by folding a fabric conduit back inside said flow passage to form a peripheral fold in said flow passage which is connectable to a gas generator, said fabric conduit initially extending from the air-bag to a position remote from the air-bag.

Conveniently said inner tubular element is provided with an open end within the air-bag.

Advantageously said inner tubular element is tapered.

Preferably the said inner tubular element is provided with one or more apertures along its length.

Advantageously the air-bag has an edge portion secured to part of the door frame of the vehicle, the said part of the door frame being non-linear, the air-bag, when inflated, being positioned adjacent the door contained within the door frame.

Conveniently the air-bag is initially stored in a recess provided in the door frame.

Advantageously the air-bag comprises a plurality of inflatable cells, the cells being adjacent and parallel, and being substantially cylindrical when inflated.

Preferably the air-bag has the opposed sides thereof inter-connected at selected points.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a sectional side view of one embodiment of the air-bag arrangement of the invention;

FIGURE 2 is a sectional side view corresponding to Figure 1, illustrating one part of the air-bag arrangement in a subsequent position, when in a motor vehicle;

FIGURE 3 is a sectional side view of an alternative embodiment of the invention; and

FIGURE 4 is a sectional side view of a further embodiment of the invention.

Referring initially to Figure 1, an air-bag 1 is made of a front layer of fabric superimposed on a back layer of fabric. The layers of fabric may be woven simultaneously as a double layered web, with parts of the web being inter-connected to form seams. This may be accomplished by, in selected areas of the web, weaving threads from one of the layers of fabric into the other of the layers of fabric. This one-piece weaving technique is disclosed in WO 90/09295.

The front layer of fabric is secured to the back layer of fabric by means of a substantially peripheral seam 2 and areas 3,4 of inter-connected fabric. A plurality of substantially vertical seams 5 are also provided between adjacent and parallel inflatable cells 6. The inflatable cells 6 are substantially cylindrical when inflated.

The inflatable cells 6 all communicate with a flow passage 7 which extends along the upper side edge 8 of the air-bag. The flow passage 7 is partly defined by an internal seam 9 which extends substantially parallel with the upper part of the peripheral seam, and which has a plurality of breaks 10, each forming a communication

between the flow passage 7 and a respective cell 6. The internal seam 9 is stepped so that the flow passage 7 has two sections of different internal diameter.

An extension of the peripheral seam 2 and a further seam 11 together define a substantially cylindrical tubular conduit 12. The conduit 12 extends away from the periphery of the air-bag and forms, in this configuration, an extension of the flow passage 7. The seam 11 is provided with a pair of breaks 13,14 which define apertures within the wall of the conduit 12.

As can be seen from Figure 2 of the accompanying drawings, a substantial portion of the conduit 12 is folded back inside the flow passage 7 such that the conduit 12 comprises an inner tubular element 15 extending through the flow passage 7. The fold 16, created at the point where the conduit 12 is folded back, defines an open end to the conduit 12, said open end being connectable to a gas generator.

By folding the portion of the conduit 12 back inside the flow passage 7, the flow passage 7 is effectively provided with a wall of double fabric thickness. This double thickness of fabric provides increased strength, thus re-enforcing the flow passage 7 such that it can withstand the high temperature and/or pressure of gas produced by the gas generator. In the case of a "cold gas" generator being utilised, the double thickness of fabric provides increased re-enforcement to withstand the initial shock wave produced as the gas is emitted.

If the fabric of the air-bag is a coated fabric, as conventionally used when helium is the inflating gas,

the coating will be on the inside of the conduit 12 when it has been folded back into the flow passage 7, thus improving the performance of the coating in protecting the fabric of the conduit.

The pair of apertures 13,14 in the wall of the conduit 12 are aligned with the breaks 10 in the internal seam 9 which communicate with the two inflatable cells 6 adjacent the area 3 of the air-bag. The inner tubular element 15 extends to a position remote from the area 3, terminating with an open end 17 positioned at a point within the air-bag in the vicinity of the area 4. Such positioning of the apertures 13,14 and 17 ensures that the initial flow of gas from the gas generator is directed towards predetermined parts of the air-bag 1.

It is to be appreciated from Figure 2 that the air-bag, when in the inflated condition as shown, extends across a door opening 18 defined by the motor vehicle. The door opening 18 accommodates a door which has a window 19 as indicated in phantom.

The air-bag 1 is initially retained within a recess which extends across the top of the door opening 18 and part of the way down an "A"-Post 20 of the vehicle. The recess is provided with a cover 21. In its initial condition, the air-bag is received within the recess and is covered by the cover 21. In the event that an accident occurs, the air-bag is inflated and the air-bag 1 occupies the position illustrated in Figure 2, where the air-bag is located in the region of the top part of the door opening 18.

It is to be understood that the predetermined parts of the bag that receive the initial flow of gas

from the gas generator are in the vicinity of the "A"-Post 20 and the "B"-Post 22 of the vehicle. It is these two areas of the air-bag which provide the most significant protection to an occupant of the vehicle, and it is thus desirable to inflate these areas first.

Referring now to Figure 3 of the accompanying drawings, an alternative embodiment of the present invention incorporates a tapered conduit 23 defined by an extension of the peripheral seam 2 and the seam 11. This conduit 23 replaces the conduit 12 previously described. The seam 11 is again provided with two breaks 13,14 which define apertures within the wall of the tapered conduit 23. As shown in phantom, a substantial portion of the tapered conduit 23 is again folded back inside the flow passage 7 such that the tapered conduit 23 comprises a tapered inner tubular element 24 extending through the flow passage 7. In this way, the flow passage 7 is again effectively provided with a wall of double fabric thickness. The two apertures defined by the breaks 13,14 in the wall of the conduit are again aligned with the breaks 10 in the internal seam 9 which communicate with the two inflatable cells 6 adjacent the area 3 of the air-bag. This is the area of the bag adjacent the "A" Post. The tapered inner tubular element 24 extends to a position remote from the area 3, terminating with a narrow open end 25 positioned at a point within the air-bag in the vicinity of the area 4. This is the area of the bag adjacent the "B" Post. Whilst the position of the open end 25 directs gas flow towards the area of the air-bag in the vicinity of the area 4, due to its reduced diameter, a lower proportion of the gas flow is directed to this area, thus producing a different inflation characteristic.

It is to be appreciated that various configurations of tapered inner tubular elements 24 may be utilised, each having individual taper characteristics, thus providing individual inflation characteristics. The tapered inner tubular element 24 may be adapted to inflate the air-bag in such a way as to provide the maximum protection for each individual vehicle.

Turning now to Figure 4 of the accompanying drawings, a further embodiment of the present invention is illustrated. Again, an air-bag 1 is provided with a plurality of inflatable cells 6, the cells being adjacent and parallel, and being substantially cylindrical when inflated. Substantially vertical seams 5 are again provided between adjacent inflatable cells 6. Towards the top of each seam 5, there is provided a curved portion 26 which curves upwardly and away from the area 3, terminating at an end 27 of each seam 5. Each end 27 defines an aperture between itself and the curved section 26 of the adjacent seam 5 remote from the area 3. Each aperture 28 forms a communication between the flow passage 7 and a respective inflatable cell 6. This curving arrangement of each seam 5, away from the gas generator, effectively streamlines the apertures 28, thus reducing the likelihood of the seams 5 tearing due to the high velocity of the gas produced by the gas generator.

Whilst the invention has been described with reference to three embodiments, it is to be appreciated that many modifications may be effected within the scope of the invention. For instance, instead of manufacturing the above-mentioned embodiments with a one-piece weaving technique, a more conventional method of construction may

be used, such as simply stitching two layers of fabric together to form the above-mentioned seams and areas.

Whilst air-bags in accordance with the invention have been illustrated, as extending across a side window opening, it is to be appreciated that air-bags in accordance with the invention may find other applications where it is desirable to inflate certain parts of the air-bag before other parts of the air-bag. Air-bags in accordance with the invention may also find applications where it is necessary, due to space constraints, to locate the gas generator remote from the air-bag, communicating with the air-bag via a relatively long and narrow channel or conduit, which channel or conduit may require reinforcement to withstand the temperatures and pressures exerted by the gas from the generator.

CLAIMS:

1. An air-bag arrangement for a motor vehicle, which air-bag arrangement comprises an air-bag adapted to be inflated in the event that an accident should occur, said air-bag being provided with a flow passage disposed therein, said flow passage being connectable to a gas generator, there being provided within said flow passage an inner tubular element.

2. An air-bag arrangement according to Claim 1, wherein said tubular element is formed by folding a fabric conduit back inside said flow passage to form a peripheral fold in said flow passage which is connectable to a gas generator, said fabric conduit initially being formed integrally with the air-bag and extending from the air-bag to a position remote from the air-bag.

3. An air-bag arrangement according to Claim 1 or 2, wherein said inner tubular element is provided with an open end within the air-bag.

4. An air-bag arrangement according to any one of the preceding Claims, wherein said inner tubular element is tapered.

5. An air-bag arrangement according to any one of the preceding Claims, wherein the said inner tubular element is provided with one or more apertures along its length.

6. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag has an edge portion secured to part of the door frame of the vehicle, the said part of the door frame being non-linear, the

air-bag, when inflated, being positioned adjacent the door contained within the door frame.

7. An air-bag arrangement according to Claim 6, wherein the air-bag is initially stored in a recess provided in the door frame.

8. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag comprises a plurality of inflatable cells, the cells being adjacent and parallel, and being substantially cylindrical when inflated.

9. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag has the opposed sides thereof inter-connected at selected points.

10. An air-bag arrangement for a motor vehicle substantially as herein described, with reference to and as shown in the accompanying drawings.

11. Any novel feature or combination of features disclosed herein.

Amendments to the claims have been filed as follows

CLAIMS:

1. An air-bag arrangement for a motor vehicle, which air-bag arrangement comprises an air-bag made of fabric adapted to be inflated in the event that an accident should occur, said air-bag being provided with a flow passage disposed therein, there being provided within said flow passage an inner tubular element formed by folding a fabric conduit back inside said flow passage to form a peripheral fold in said flow passage which is connectable to a gas generator, said fabric conduit initially being formed integrally with the air-bag and extending from the air-bag to a position remote from the air-bag.

2. An air-bag arrangement according to Claim 1, wherein said inner tubular element is provided with an open end within the air-bag.

3. An air-bag arrangement according to any one of the preceding Claims, wherein said inner tubular element is tapered.

4. An air-bag arrangement according to any one of the preceding Claims, wherein the said inner tubular element is provided with one or more apertures along its length.

5. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag has an edge portion secured to part of the door frame of the vehicle, the said part of the door frame being non-linear, the air-bag, when inflated, being positioned adjacent the door contained within the door frame.

6. An air-bag arrangement according to Claim 5, wherein the air-bag is initially stored in a recess provided in the door frame.

7. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag comprises a plurality of inflatable

cells, the cells being adjacent the parallel, and being substantially cylindrical when inflated.

8. An air-bag arrangement according to any one of the preceding Claims, wherein the air-bag has the opposed sides thereof inter-connected at selected points.

9. An air-bag arrangement for a motor vehicle substantially as herein described, with reference to and as shown in the accompanying drawings.

The Patent Office

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Application No:	GB 9613001.8	**Examiner:**	J. C. Barnes-Paddock
Claims searched:	All	**Date of search:**	18 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7B (BSB)

Int Cl (Ed.6): B60R 21/16, 26

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1,455,661	(AB INVENTING) Fig. 4, Notice bag 3, flow passage 5 and tubular element 4.	1
X	GB 1,406,067	(BENDIX) Figs. 1, 2	1
X	GB 1,319,389	(ALLIED CHEMICAL) Fig. 2 Note the tubular element in the mouth of the bag	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.